A Comparison of FE Analysis of Columns Utilizing Two Stress-Strain Material Relations and Two Different Solvers: ANSYS vs. SCIA Engineer

Daniel Jindra*, Jiří Kala* and Zdeněk Kala*

* Institute of Structural Mechanics (STM) at the Faculty of Civil Engineering (FCE) of the Brno University of Technology (BUT)
Veveří 331/95, 602 00 Brno, Czech Republic
e-mails: jindra.d@fce.vutbr.cz, kala.j@fce.vutbr.cz, kala.z@fce.vutbr.cz
web page: http://www.fce.vutbr.cz

ABSTRACT

Paper presents results of the advanced numerical simulation processes of duplex stainless steel columns. The finite element analyses are conducted utilizing two different implicit solvers: ANSYS Classic technology and the FEM solver implemented in the SCIA Engineer software. Force-deflection curves along with the ultimate axial load and the corresponding ultimate mid-height lateral deflection of duplex stainless steel (EN grade 1.4462) columns in compression are compared with the results of experimental programme. 9 different column lengths (EN slenderness classes 3 and 4) of circular hollow cross-section (CHS) 88.9×2.6 have been analysed, and the results are statistically compared.

Two approaches of the material stress-strain relation definition are compared. The first one is in accordance with a behaviour description proposed by Ramberg and Osgood, here utilized as multilinear material model with isotropic hardening and Von Mises yield surface plasticity. The second approach adopts a simplified linear elastic relation up to the 0.2% proof stress value (the equivalent of the yield strength) and linear plastic behaviour with defined hardening.

The difference between results obtained from both numerical solvers (ANSYS and FEM solver within SCIA) are rather negligible and both in a nice match with the experimental data. In order to describe the material behaviour of the stainless steel properly, the stress-strain relation is required to be defined more precisely. The simplified bilinear definition of the stress-strain curve does not seem to be suitable enough to obtain validated results of the numerical analyses.

[1] C. Buchanan, E. Real and L. Gardner, “Testing, simulation and design of cold-formed stainless steel CHS columns.”, *Thin-Walled Structures*, **130**, 297-312 (2018). ISSN: 0263-8231. doi:10.1016/j.tws.2018.05.006.
[2] Ansys, Inc. ANSYS 19.0. Canonsburg, PA 15317 U.S.A., 2018.
[3] Nemetschek Group. SCIA Engineer 20.0. Hasselt 3500 Belgium,2020.